Brian Munsky

Los Alamos National Lab
Center for Nonlinear Studies
TA-3, Bldg 1690, Room 117; Los Alamos, NM 87545
brian.munsky@gmail.com

EDUCATION

⋄ **The University of California at Santa Barbara**, Santa Barbara, CA
Center for Control, Dynamical Systems, and Computation
Ph.D. in Mechanical Engineering; Advisor: Mustafa Khammash
Sep. 2003–June 2008; GPA: 3.86/4.00
Dissertation topic: *Modeling and Analysis of Stochastic Networks in Biological Systems.*

⋄ **The Pennsylvania State University**, University Park, PA.
M.S. in Aerospace Engineering, Advisor: Farhan Gandhi
Aug. 2000–Aug. 2002; GPA: 3.88/4.00
Thesis topic: *Fluid/Structural/Acoustic Analyses of Helicopter Blade-Vortex Interactions.*

⋄ **The Pennsylvania State University**, University Park, PA.
B.S. in Aerospace Engineering, Advisors: Farhan Gandhi and Ed Smith
Aug. 1996–May 2000; Junior/Senior GPA: 3.92/4.00
Honors thesis topic: *Active/Passive Damping Treatments to Alleviate Resonant Oscillations.*

HONORS AND
AWARDS

⋄ Director's Postdoctoral Fellowship at the Los Alamos National Lab (July 2008-2010).

⋄ UCSB Department of Mechanical Engineering Best Ph. D. Dissertation Award for the 2007-2008 Academic Year.

⋄ Best Presentation in Session, 27th American Controls Conference in Seattle, WA, (June 2008).

⋄ Selected to present one of six student talks at the Eighth International Conference on Systems Biology, Long Beach, CA (Oct. 2007)

⋄ Selected to present one of ten contributed talks at the first q Bio Conference on Cellular Information Processing, Santa Fe, NM (Aug. 2007)

⋄ UCSB Chancellor's Fellowship (Sep. 2003–May 2008)

⋄ UCSB Department of Mechanical Engineering Graduate Fellowship (Sep. 2003–May 2008)

⋄ National Defense Science and Engineering Graduate (NDSEG) Fellowship (2001–2002)

⋄ American Helicopter Society Vertical Flight Foundation Award (Twice: 1999, 2000)

⋄ Penn State University College of Engineering Graduate Fellowship (2000–2001)

⋄ Mary Ilgen Memorial Scholarship (1999–2000)

⋄ Graduated with Honors from the Penn State Schreyer Honors College (May 2000)

⋄ Penn State Deans List (7 times)

⋄ Schreyer Honors College Academic Excellence Award (1996-2000)

RESEARCH
EXPERIENCE

⋄ **Director Funded Postdoctoral Fellow**, Center for Nonlinear Studies (CNLS) and the Information Sciences Group (CCS-3), Los Alamos National Lab.
In order to complement my engineering training, I am collaborating closely with physicists, information scientists and computational engineers to develop and apply computational methods for the reduction (coarse-graining) and analysis of large scale stochastic processes (Jul. 2008 to Present).

⋄ **Graduate Research Assistant**, Dept. Mechanical Engineering, UC-Santa Barbara.
Working closely with experimental biologists, I have developed and validated a stochastic model of the Pap Pili epigenetic switch in *E. coli*. During the course of this research, I have developed an array of new analytical tools to solve the master equations for discrete state, continuous time Markov processes (Jan. 2004 to Jun. 2008).

⋄ **Graduate Research Assistant**, Dept. Aerospace Engineering, Penn State University.
As a research assistant at the Rotorcraft Center of Excellence (RCOE), I developed a Finite Element aeroelastic model to simulate a helicopter in forward flight. Working closely with other students, I coupled this model with a free wake aerodynamic analysis and an aero-acoustic prediction code. I used this model to study of the effects of helicopter flight trajectory on the noise due to Blade-Vortex Interactions (May 2000–Aug. 2002).

⋄ **Undergrad Research Assistant**, Dept. Aerospace Engineering, Penn State University.
Using Finite Element Analysis, I performed parametric studies to ascertain the optimal design and control of an Active Constrained Layer Damping treatment with viscoelastic materials for the alleviation of resonant oscillations (May, 1999–May, 2000).

⋄ **Undergrad Research Assistant**, Dept. Aerospace Engineering, Penn State University.
As a research assistant at the RCOE, I played a pivotal role in the analysis, design, and construction of a piezoelectric actuator for rotor blade trailing edge flaps (Jan. 1999–Aug. 1999).

TEACHING AND TUTORING EXPERIENCE

⋄ **Course Development and Teaching**, Dept. Mechanical Engr., UC-Santa Barbara.
Together with Mustafa Khammash, I co-developed and co-taught a new graduate level course on the modeling and analysis of stochastic gene regulatory networks. Duties included researching material, preparing and giving lectures, and assigning and grading homeworks and exams (Spring, 2007). We condensed this course to a three hour tutorial session titled: "Stochastic Gene Expression in Systems Biology," which we were invited to present at the *Eighth International Conference on Systems Biology* (Oct. 2007) and at the 2nd q-bio Conference on Cellular Information Processing (Aug. 2008).

⋄ **Guest Lectures and Presentations**, First q-bio Summer School on Cellular Information Processing, Los Alamos National Laboratory (July, 2007). As part of a summer school for graduate students and postdocs in the field of systems biology, I gave a one hour student lecture on Finite State Projection based approaches for the solution of the chemical master equation. In the second annual q-bio summer schools (July, 2008), I was invited to give three 100 minute tutorial lectures on related materials.
While at UCSB and LANL, I have given several lectures and presentations on stochastic modeling of gene regulatory networks for groups such as the NSF Integrative Graduate Education and Research Traineeship (IGERT) program, the Institute for Collaborative Biology (ICB), the UCSB Theoretical Ecology Seminar, and the Center for Nonlinear Studies (CNLS).

⋄ **Graduate Teaching Assistant**, Dept. of Aerospace Engineering, Penn State University.
As a teaching assistant of a course on the numerical analysis of aerospace structures, I prepared and delivered weekly review sessions; assigned, solved, and graded biweekly homework assignments; and provided group and one-on-one tutoring to students (Spring, 2001).

⋄ **Writing Tutor**, University Learning Resource Center, Penn State University.
As a trained peer tutor for writing, I assisted undergraduate, graduate and ESL (English as a Second Language) students at the Penn State Writing Center (Jan.–Dec. 1997).

ARTICLES, CONFERENCE PAPERS, AND TALKS

Full papers downloadable at: http://cnls.lanl.gov/External/people/Brian_Munsky.php

Systems Biology

⋄ B. Munsky and M. Khammash, Listening to the noise: Random fluctuations reveal gene network parameters, *Submitted*, Jan. 2009.

⋄ B. Munsky, G. Bel, N. Sinitsyn, and I. Nemenman, Stochastic waiting times of complex biochemical reactions may exhibit universal behavior, *Abstract: APS March Meeting*, Mar. 2009.

⋄ G. Bel, B. Munsky, and I. Nemenman, Common complex biochemical processes exhibit simple completion time distributions, *Submitted*, Mar. 2009.

⋄ B. Munsky and M. Khammash, Using Noise Transmission Properties to Identify Stochastic Gene Regulatory Networks, *Invited Paper: Proc. of the 47th IEEE Conference on Decision and Control*, Cancun, Mexico, Dec. 2008.

⋄ B. Munsky and M. Khammash, Transient Analysis of Stochastic Switches and Trajectories with Applications to Gene Regulatory Networks, *IET Systems Biology*, **2**, no. 5, pp. 323-333, Sept. 2008.

⋄ B. Munsky and M. Khammash, Computation of Switch Time Distributions in Stochastic Gene Regulatory Networks, *Invited Paper–Proc. of the 27th American Control Conference*, Seattle, WA, Jun. 2008. *Best Presentation Award.*

⋄ B. Munsky and M. Khammash, The FSP Approach for the Analysis of Stochastic Noise in Gene Networks, *IEEE Trans. Automat. Contr./IEEE Trans. Circuits and Systems: Part 1*, **52**, no. 1, pp. 201-214, Jan. 2008.

⋄ P. Inglesias, M. Khammash, B. Munsky, E. Sontag and D. Del Vecchio, Systems Biology and Control – A Tutorial, *Proc. of the 46th IEEE Conference on Decision and Control*, New Orleans, LA, Dec. 2007.

⋄ B. Munsky and M. Khammash, Sensitivity Analysis and Parameter Identification of Stochastic Gene Regulatory Networks using Finite State Projection Techniques, *Selected Talk: Eighth International Conference on Systems Biology*, Long Beach, CA, Oct. 2008.

⋄ B. Munsky and M. Khammash, A Multiple Time Interval Finite State Projection Algorithm for the Solution to the Chemical Master Equation, *J. Comp. Phys.*, **226**, no. 1, pp. 818-835, Sept. 2007.

⋄ B. Munsky, Finite State Projection Solutions to the CME Arising in Gene Regulatory Networks, *Selected Talk: q-Bio Conference on Cellular Information Processing*, Santa Fe, NM, Aug. 2007.

⋄ B. Munsky and M. Khammash, Analysis of Noise Induced Stochastic Fluctuations in Gene Regulatory Networks, *J. SICE*, **46**, no. 5, pp. 405-411, May 2007.

⋄ M. Khammash and B. Munsky, Systems Theory Applications in Biology: From Stochastic Chemical Kinetics to Deterministic Model Invalidation, *Invited Paper–Proc. of the European Control Conference*, Kos, Greece, Jul. 2007.

⋄ B. Munsky, S. Peleš and M. Khammash, M., Stochastic Analysis of Gene Regulatory Networks Using Finite State Projection and Singular Perturbation, *Invited Paper–Proc. of the 26th American Control Conference*, New York, NY, pp. 1323-1328, Jul. 2007.

⋄ B. Munsky and M. Khammash, A Reduced Model Solution for the Chemical Master Equation Arising in Stochastic Analyses of Biological Networks, *Proc. of the 45th IEEE Conference on Decision and Control*, San Diego, CA, pp. 25-30, Dec. 2006.

⋄ S. Peleš, B. Munsky and M. Khammash, Reduction and Solution of the Chemical Master Equation Using Time Scale Separation and Finite State Projection, *J. of Chemical Physics*, **125**, no. 20, 204104, Nov. 2006.

⋄ B. Munsky and M. Khammash, Modeling and Analysis of a Bacterial Stochastic Switch, *Proc. of the 14th Mediterranean Conference on Control and Automation*, Ancona, Italy, pp. 1-6, Jun. 2006.

⋄ B. Munsky and M. Khammash, The Finite State Projection Algorithm for the Solution of the Chemical Master Equation, *J. of Chemical Physics*, **124**, no. 4, 044104, Jan. 2006.

⋄ B. Munsky, A. Hernday, D. Low, and M. Khammash, Stochastic Modeling of the Pap Pili Epigenetic Switch, *Proc. of Foundations of Systems Biology in Engineering*, Santa Barbara, CA, pp. 145-148, Aug. 2005.

Structural Dynamics

⋄ B. Munsky, F. Gandhi and L. Tauszig, Analysis of Helicopter Blade-Vortex Interaction Noise with Flight Path or Attitude Modification, *J. American Helicopter Society*, **50**, no. 2, pp. 123-137, Apr. 2005. Earlier version available as B. Munsky, F. Gandhi and L. Tauszig, *Proc. of the 58th Annual Forum of the AHS, Acoustic Session*, **2**, Montreal, Canada, pp. 1531-1551, Jun. 2002.

⋄ F. Gandhi and B. Munsky, Effectiveness of Active Constrained Layer Damping Treatments in Attenuating Resonant Oscillations, *J. of Vibration and Controls*, **8**, no. 6, pp. 747-775, 2002.

Earlier version available as B. Munsky and F. Gandhi, *Proc. of the AIAA/ ASME/ ACSE/ AHS/ ASC Structures, Structural Dynamics, and Materials Conference*, Seattle, Washington, Apr. 2001.

⋄ F. Gandhi and B. Munsky, Comparison of Damping Augmentation Mechanisms with Position and Velocity Feedback in Active Constrained Layer Treatments, *J. of Intelligent Material Systems and Structures*, **13**, no. 5, pp. 259-326, May 2002. Earlier version available as: F. Gandhi and B. Munsky, Comparison of the Mechanism and Effectiveness of Position and Velocity Feedback in Active Constrained Layer Damping Treatments, *Proc. of SPIE Smart Structures and Materials*, **3989**, Orange County, CA, pp. 61-72, Mar. 2000.

⋄ L. Centolanza, E. Smith and B. Munsky, Design, Fabrication, and Experimental Testing of an Induced-Shear Piezoelectric Actuator for Rotor Blade Trailing Edge Flaps, *Smart Materials and Structures*, **11**, pp. 24-35, Feb. 2002.

Skills   ⋄ **S**ystems and Control theory based modeling and analysis techniques for biological systems. These include tools for sensitivity and robustness analysis, model reduction, and parameter identification for complex bio-networks.

⋄ **N**umerical methods for stochastic systems: stochastic simulations, τ leaping, hybrid methods, Stochastic Differential Equations, Finite State Projection reductions for master equations, and others.

⋄ **N**umerical analyses of PDEs using finite difference, finite element, Raleigh-Ritz, and other approaches.

⋄ **C**/C++, Fortran, Matlab, Unix, Linux, MS-Windows, Mac OS X, LaTeX, Maple, Mathematica and others.

Professional   ⋄ Referee for *Journal of Physics A: Mathematical and Theoretical*, *Physics Letters A*, IEEE
Activities   Conference on Decision and Control, IEEE American Controls Conference, IFAC Symposium on System Identification, *IET Systems Biology*, *Biotechnology Progress*, *PLoS Computational Biology*, and *Smart Materials and Structures*.

⋄ Member of the Institute of Electrical and Electronics Engineers (IEEE), American Physical Society (APS) and the American Association for the Advancement of Science (AAAS).

⋄ Co-Organizer (with David Thorsley) of the Second Workshop on Stochasticity in Biochemical Reaction Networks, to be held at the Banff International Research Station (BIRS) in Banff, Canada on Sep. 25 - Sep. 27, 2009.

References   ⋄ Available upon request.